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EVALUATION OF NON-CHROMATED ETCH FOR ALUMINUM ALLOYS (P-ETCH).(U)
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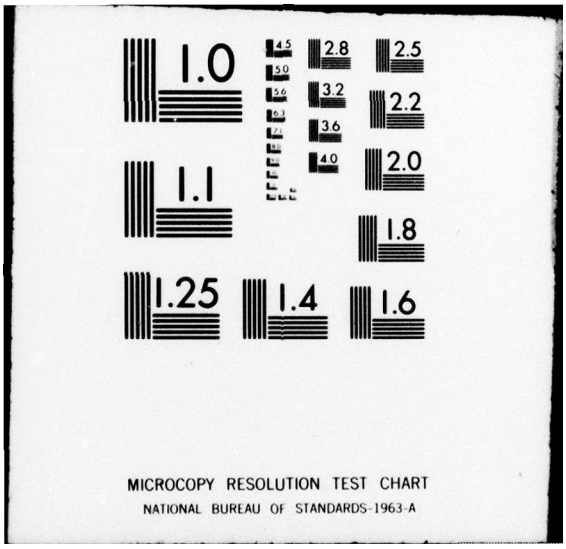
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PROGRESS REPORT

FOR

(15) CONTRACT NO. DAAK10-78-C-0398 New

(6) TITLE EVALUATION OF NON-CHROMATED ETCH FOR ALUMINUM ALLOYS (P-ETCH).

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INTRODUCTION

The purpose of the work performed under this program is to evaluate the new chromate free etchant developed by US Army (ARRADCOM) for use in the preparation of aluminum alloys for adhesive bonding.

The objective of the program is to generate data which will determine the suitability of the etchant for production use.

It will establish the operational control procedures necessary for scale-up to production size and the impact of the solution on existing state-of-the-art waste disposal techniques will be studied. The surfaces produced will be studied to establish their chemical and physical nature.

Selected adhesives will be used to explore the effects of solution concentration limits, solution life and storage time prior to bonding, as well as resistance to water immersion, high humidity, salt spray, heat, and cold, and immersion in fuel, lubricating oil and hydraulic fluid. In each case where applicable, panels prepared by the standard FPL etch treatment will be used as controls.

In addition to the as-etched surfaces, the P-Etch will be used as a pretreatment prior to chromic acid and phosphoric acid anodize, and the resultant anodic treated surfaces will be tested for bondability and durability of the bonded joints.

CONTRACT NO. DAAK 10-78-C-0398

EVALUATION OF NON-CHROMATE ETCH
FOR ALUMINUM ALLOYS (P-ETCH)

Interim Technical Report No. 1

This is the first Quarterly Technical Report to be issued concerning the work to be performed under Contract No. DAAK 10-78-C-0398. This report covers the period 27 September 1978 through 30 December 1978.

The following is a brief description of the tasks to be performed during this part of the evaluation of the non-chromated etch process for aluminum.

PHASE I - SOLUTION CONTROL

Solutions will be prepared at selected maximum and minimum concentration limits. Analysis procedures, which may be used to determine the concentration of significant constituents in the solution, will be evaluated. Known amounts of aluminum will be dissolved in the solutions and the significant constituents analyzed to establish the validity of the analysis procedures for use under production conditions and to evaluate the depletion rate of certain constituents.

Suitable test coupons will be prepared and subjected to various tests to determine the effects of the process procedures on the mechanical properties of the metals.

The program has been amended to provide for evaluation of the P_2 etch in lieu of the P etch. The solution control phase of the program is being conducted on schedule.

Progress Accomplished

The P_2 solution has been prepared at concentration levels approximately 10% above and 10% below the concentration shown in Technical Report ARLCD-TR-78001.

Preparation of P_2 Etch

Solution No.	Solution Concentration	H_2SO_4 wt/g/l	Ferric Sulfate wt/g/l
1.	+10%	407.0	165.0
2.	+ 5%	388.5	157.5
3.	Std	370.0	150.0
4.	- 5%	351.5	142.5
5.	-10%	333.0	135.0

Portions of these solutions have been used to dissolve various amounts of aluminum. These solutions were then used to evaluate analysis techniques.

A procedure for determination of total acid has been selected and it appears to be satisfactory. The procedure is a simple acid-base titration using standard sodium hydroxide. Potassium fluoride is used to complex the iron and tribasic sodium citrate is used to complex the sluminum to prevent their interference.

Analysis Procedure for Sulfuric Acid

1. Pipette 1 ml of sample into a 250 ml Erlenmeyer flask containing 100 ml distilled water.

2. Add 1 gram of tribasic sodium citrate and 1 gram sodium fluoride.

3. Add a few drops of phenolphthalein indicator.

4. Titrate with 0.4 N NaOH (Sodium Hydroxide) to a clear or faint pink.

5. Calculations

   A. ml 0.4N NaOH x 0.4 = N Sulfuric Acid

N Sulfuric Acid to Percent by wt (gm/100 gm)

4.65 N = 20%	6.01 N = 25%	7.46 N = 30%
4.91 N = 21%	6.29 N = 26%	7.76 N = 31%
5.18 N = 22%	6.58 N = 27%	8.06 N - 32%
5.45 N = 23%	6.86 N = 28%	8.37 N - 33%
5.73 N = 24%	7.16 N = 29%	

   B. ml 0.4 N NaOH x 1.066 = % by vol Sulfuric Acid

Additional analysis procedures for determination of both ferric and ferrous iron are being studied.

The solutions were also used to etch 2024-T3 (Bare) aluminum panels for various times and the weight loss calculated.

The weight losses in mg/sq ft are as follows:

Immersion Time	High Conc.	Low Conc.
5 minutes	323	289
10 minutes	676	699
15 minutes	980	1229
20 minutes	1328	1840

Fresh solutions were not used for each of the above immersion times. Therefore, the ferric ion concentration was depleted more completely in the low concentration solution and this allowed more aggressive attack. This depletion is evidenced by a change in the solution color from red to green. Also, when the solution is depleted to a certain point, copper is immersion plated onto the aluminum surface.

Work to be Accomplished During the Next Reporting Period

Work will continue on evaluation of analysis procedures and on the effects of the solutions on metal properties.

N. L. Rogers 1-8-79
Project Engineer

699-099-104

PLAN OF PERFORMANCE

EVALUATION OF NONCHROMATED ETCH

DAAK10-78-C-0398